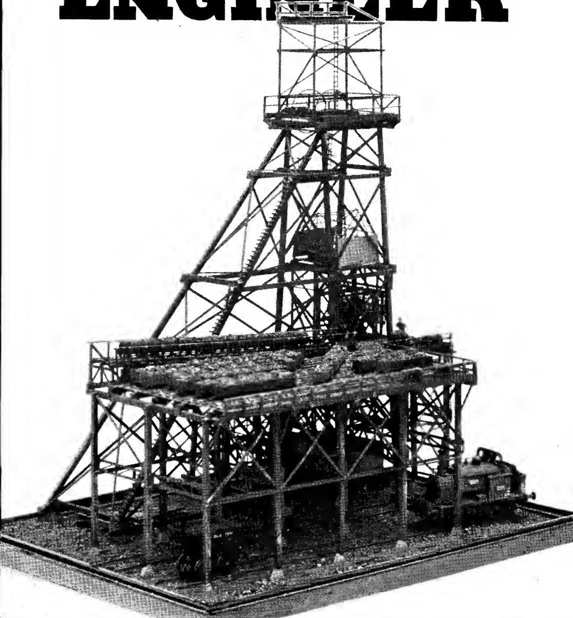
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

16TH SEPTEMBER 1948 VOL. 99 NO. 2469

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SMOKE RINGS

Our Cover Picture

● THE MODEL pit-head gear selected for our cover illustration this week, was entered in the recent MODEL ENGINEER Exhibition by Mr. W. E. Appleby, of Westcliff-on-Sea.

It was Mr. Appleby who broadcast an account of his model-making activities in the "Eye Witness" and also the "In Town Tonight" programmes of the B.B.C. during the exhibition.

His model is remarkable for the accuracy of detail and finish, and he assures me that some of the soot and coal dust which begrime the full size structure has been used to produce a realistic finish to his model. Even the chalk tally marks made by the engine driver on the side of the cab have been faithfully reproduced on the model saddle tank locomotive.

What is perhaps an even more remarkable feature of this model is that the structure itself was built and completed by Mr. Appleby in two weekends, and the saddle tank locomotive in a further two weekends. He assures me, too, that he has at his home more than a thousand models of various types, principally miniatures, which he has constructed in his rather limited spare time; and having seen in the back of his car some sixty or seventy models which he brought with him when delivering his entry, I am sure that this remarkable achievement is in no way exaggerated. Perhaps the secret of his prolific output lies in the fact that his occupation is that of a production engineer.—P.D.

A Model-maker's Luck

● MR. J. A. KAY, winner of the second prize in the recent "M.E." Photographic Competition, seems to have had an extraordinary run of good fortune for which he feels that he is indebted to his hobby. He states that, when he received the prize cheque, he was unemployed; but the same post brought him an offer of employment, and this recalled that something similar had happened to him before.

In 1934, during a spell of unemployment, he kept his morale and skill in trim by completing a small triple-expansion marine engine which he sent to the "M.E." Exhibition in that year. The engine won a Silver Medal and an additional prize of £5. Soon after this, Mr. Kay obtained a job in one of H.M. Dockyards, and was happily engaged in instrument making for fourteen years. He was then obliged to leave for another locality and found himself once more out of work.

In the meantime, another triple-expansion marine engine was built and was entered in this year's "M.E." Exhibition Competition; it won the Championship Cup in its class! I think such a sequence of events is really extraordinary, and I hope it will long continue.—J.N.M.

The Wakefield Trophy Returns

● NEWS HAS just been received from the U.S.A. of the success of a member of the British team, R. B. Chesterton, of Northampton, in winning for this country the Wakefield International Trophy for model aircraft. This trophy, presented by the late Viscount Wakefield to the Society of Model Aeronautical Engineers in 1927 for competition by national teams, has now been won by Great Britain six times, the U.S.A. five and France once. The contest is held in the country winning the trophy the previous year and this year's contest—the first since the war—was held at Akron, Ohio, on August 27th.

Besides Mr. Chesterton, who was placed first in the final trials, the team consisted of Messrs. A. D. Piggott (Croydon), R. Copland (Northern Heights), J. J. King (West Essex), C. Doughty (Birmingham) and L. Stott (Bradford).

In view of the present currency difficulties, the American Controlling Body undertook to sponsor the chartering of a transatlantic air liner to convey the European teams to the venue of the contest; unfortunately, this arrangement broke down at the last moment and the S.M.A.E. found itself with a team but no means of getting it to the U.S.A. Nothing daunted, they set about the formidable task of raising the £1,000 necessary in the extremely short period remaining, and thanks to the generous and prompt support of the members of the aircraft industry, the model aircraft trade, the clubs, and individual enthusiasts, sufficient funds were raised in time to send the team.

This splendid result could only have been achieved through the efforts of an authoritative body such as the S.M.A.E., which holds a mandate from the Royal Aero Club for the control of International and National Model Aircraft contests in this country. Everyone concerned in this outstanding endeavour to bring the trophy back to this country deserves the congratulations of all model engineers.—E.F.H.C.

Some of the cups and prizes awarded to competitors in the recent " Model Engineer " Exhibition

An Ipswich Exhibition

● MR. F. SHACKLETON, of the Ipswich and District Society of Model and Experimental Engineers, informs me that an exhibition will be held in the St. Matthew's Baths Hall, Ipswich, from October 2nd to 9th next. The hours of opening will be 6 p.m. to 10 p.m. each day, except Wednesday and Saturday when the opening time will be 3 p.m. Organised parties from other societies can be given a private view on Sunday, October 3rd. Any club secretary wishing to arrange for the private view should get into touch with Mr. Shackleton, whose address is 23, Clapgate Lane, Ipswich.—J.N.M.

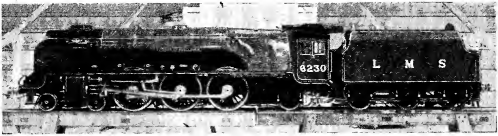
Staff Vacancy

● AN OPPORTUNITY with exceptional possibilities on the staff of the Percival Marshall organisation is offered to a young man having the necessary qualifications.

A first essential is that he shall have had a good training in commercial art and shall have a flair for layout, lettering and retouching. An interest in models generally and model cars and racing cars in particular, is also a desirable qualification. Residence in or near London is essential.

This appointment will, of course, be subject to the provisions of the Control of Engagement Order, 1947.

Applications for this position must be addressed in writing to the Production Manager, Percival Marshall Periodicals, 23, Great Queen Street, London, W.C.2.—P.D.



Mr. H. C. Powell's $1\frac{1}{2}$*-in. scale L.M.S. Pacific "Duchess of Buccleuch"*

The Locomotive Section of the "M.E." Exhibition

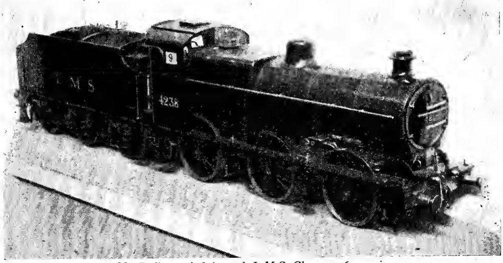
by J. N. Maskelyne, A.I.Loco.E.

THE following notes deal solely with the exhibits in what the Exhibition Catalogue described as Section B, Class 1; that is to say, the locomotives for $1\frac{3}{4}$-in. gauge and larger. The general standard of workmanship and finish was as high as I have ever seen it; in fact, I doubt if it could have been much higher, and my co-judges, George Dow and F. C. Hambleton, were as much impressed as I was.

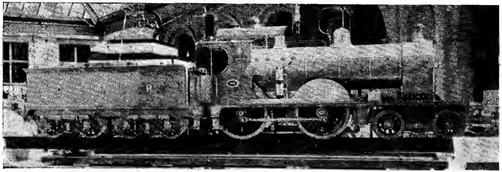
It seems that the great majority of visitors decided upon the Locomotive Championship Cup winner at first glance, and they all appeared to be quite sure of it. To the judges, however, the decision was by no means as simple as that! Mr. H. C. Powell's entry-form provided some details which required the most careful consideration, and this eventually led to a severe handicap being placed upon his entry. In spite of this, however, the result of the judging left no doubt as to the proper award for a wonderful piece of work. I have asked Mr. Powell to provide me with a description of the model and its construction for publication in due course.

A very close second was Mr. F. Cottam's $\frac{3}{4}$-in. scale G.W.R. "King" class engine which was almost, if not quite as complete in detail as Mr. Powell's "Duchess." Mr. Cottam gained a Silver Medal and the Curwen Prize, in spite of one or two surprising blemishes on the model. The date-plates on the leading splashers and the fact that the safety-valve casing is not the correct size or shape marred the accuracy of an otherwise superb model.

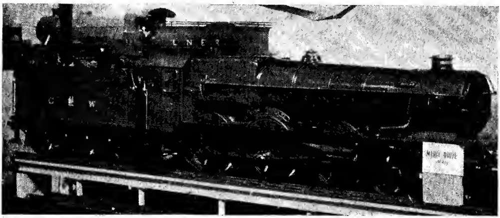
Three Bronze Medals were awarded in this class; they went, respectively, to: Mr. J. M. Crowther's $7\frac{1}{4}$-in. gauge "Midge"-type engine



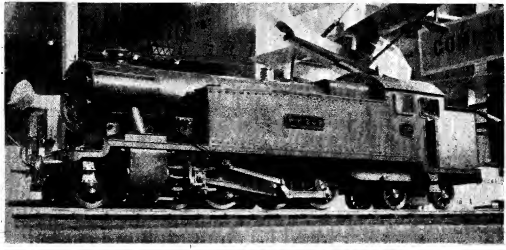
Mr. R. Jacques's $\frac{3}{4}$*-in. scale L.M.S. Class* 4 0-6-0 *engine*



Mr. W. H. Dearden's 1-in. scale Caledonian Railway 4-4-0 engine

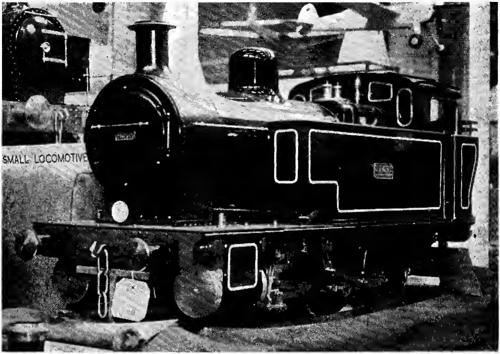


Mr. F. Cottam's ¾-in. scale G.W.R. "King" class locomotive



Mr. J. H. Westwood's 5-in. gauge "Halton Tank" locomotive

Belinda; Mr. W. D. Hollings's 7¼-in. gauge L.M.S. "Dock Shunter" 0-6-0T, and Mr. M. E. Moon's 1/7-scale replica (3½-in. gauge) 0-4-0 Quarry locomotive. Of these, the first is probably the best-finished "Midge" yet built, and Mr. Crowther has provided it with the correct style of cab. Mr. Hollings's Dock engine is already well known, especially in Yorkshire



Mr. W. D. Hollings's 1½-in. scale L.M.S. "Dock Shunter"

and Lancashire, and it is a splendid piece of work; but it appears to be likely to cause another controversy in model engineering circles because of the extensive and most unusual use of Allen screws! Mr. Moon's Quarry locomotive is a delightful job incorporating some ingenious features, faithfully copied from the prototype, and the most striking of these is, perhaps, the method of operating the couplings from the footplate.

Mr. W. H. Dearden's 1-in. scale Caledonian 4-4-0 engine, Mr. R. Jaques's ¾-in. scale L.M.S. "4F" 0-6-0 goods engine, and Mr. J. Refoy's $\frac{13}{16}$-in. scale G.W.R. 2-4-0, *Isis*, all thoroughly deserved the V.H.C. diplomas awarded to them. None of the three was free from faults, from the point of view of accuracy to prototype; but, at least, none of the three was guilty of deliberate distortion. On account of his advanced age, Mr. Dearden was given an additional special award for the meritorious effort he had obviously put into the construction of his engine.

Mr. J. Knighton's ¾-in. scale L.M.S. "Class 5" 4-6-0 engine and Mr. J. H. Westwood's 5-in. gauge "Halton Tank" locomotive each gained an H. C. Diploma. Both were very good examples of their kind, but Mr. Knighton would do better if he paid a little more care to such details as the shape and size of chimney and dome; such matters, slight and comparatively unimportant from the utilitarian point of view, count for much nevertheless, in a keen competition.

The ¾-in. scale L.M.S. Pacific, *The Princess Royal*, by Mr. H. Lester, and Mr. R. J. Smith's 5-in. gauge version of the U.S. Army "European Austerity" 2-8-0 locomotive were each awarded a C. Diploma, well deserved in each case. Mr. Lester, however, might give more attention to the painting of his engine, while Mr. Smith had somehow just failed to achieve a really satisfactory degree of realistic finish in his fine engine.

There were some, but commendably few, examples of round-headed screws in the wrong places; but, in view of the prevailing difficulties in obtaining the proper thing, the judges agreed to take a lenient view of this particular error. There is still too great a tendency to skimp the finish of wheels by the lack of any attempt to represent tyres. In at least one case, the radii at the outer ends of the spokes had been finished flush with the outer faces of the (missing) tyres, producing a really dreadful effect. But of this, more anon! The obvious remedy, of course, is to examine the castings thoroughly and to avoid using those which are likely to produce this effect.

Supplementary Exhibition Awards

This list which is additional to that published in last week's issue, gives the winners of the special awards, cash value and goods prizes

The New York Society of Model Engineers, Inc. Prize

H. G. Bell, of Cambridge. Radio-controlled working model "J" class destroyer.

The Westbury Prize

R. E. Mitchell, of Runcorn. 15-c.c. two-stroke for Class B hydroplane propulsion.

The C.M.L. Prize

W. Savage, of Wallington. 4-cylinder water-cooled petrol engine.

The Hampshire Prize

D. McNarry, of Barton-on-Sea. Waterline model *R.M.S. Queen Elizabeth.*

The Muller Prize

J. K. Nelson and K. Tyler, of Ilford. Model of typical L.N.W.R. station in an industrial setting.

The David Curwen Ltd. Cup

F. Cottam, of Greenford. ¾-in. scale G.W.R. "King" class locomotive.

The Messrs. A. J. Reeves & Co. Prize

A. F. Winter, of Portslade-by-Sea. Generating set—steam engine, dynamo and switchboard.

The McGuffie Prize

R. Edgar, of Peckham, S.E.15. Ship model, *Golden Hind.*

The Wing-Commander Lewis Prize

F. H. Buckley, of Ashford, Middx. One-sixth scale model of "P" type 8-h.p. M.G. car chassis.

The Dr. Macartney Prize

W. H. Dearden, of Ashtead. 1-in. scale Caledonian locomotive 142.

The Quickset Toolholder Co. Prize

W. C. Crisp, of Flitwick. Stationary horizontal steam engine.

The G. W. Hole Prize

G. F. Wills, of Leyton, E.10. ¼-scale motor-cycle (unfinished) with engine completed.

"The Model Engineer" Prize

K. N. Harris, of Wealdstone. Vertical plain dividing head and various adaptors; faceplate and eccentric chuck for 4¾-in. centre lathe; group of small accessories for lathe.

The "Model Railway News" Prizes

First Prize.—P. R. Masor, of Kirkcaldy. "OO" gauge North Eastern Class "Z" Atlantic locomotive and tender.

Second Prize.—W. Reeves, of Brighton. "O" gauge working steam model of L.B. & S.C.R. E.2 class tank.

Third Prize.—A. J. Thorn, of Northwood. "OO" gauge model of *ex*-Great Central Railway 0-8-4 shunting tank, now L.N.E.R. Class S.1.

The "Model Ships and Power Boats" Prize

D. May, of Lymington. Electrically-driven free-lance design of yacht's tender.

The "Model Car News" Prizes

Two Guineas.—H. C. Wainwright, of Leicester. Scale outline of the Alfa-Romeo Type 158.

One Guinea.—W. P. Jones, of Gedling. G.P. Bugatti French racing car, Type 51, 2.3 litre.

The "Model Car News" Special Prize

F. G. Boler, of Leatherhead. Model racing car (self-propelled).

Model Aircraft Awards

A complete list of prize winners in the Model Aircraft section is announced in the September issue of *Model Aircraft.*

The W. K. Waugh Prizes

Set of "Hielan' Lassie" Castings.—W. Lynch, of Leeds. 5-in. gauge steam locomotive and tender.

Set of "O" Castings.—W. F. Gentry, of Westbury-on-Trym. "O" gauge, 0-6-0 Southern E.2 tank locomotive.

The Messrs. Perfecto Engineering Co. Prize

Set of Castings for a Drilling Machine.—T. Spike, of Topsham. Model power shaping machine.

The Messrs. Hadrill & Horstmann Ltd. Prize

The "Horstmann" Pluslite.—L. Shepherd, of Bolton. 2-in. centre lathe.

The Myford Engineering Co. Prize

Swivelling Vertical Slide.—A. J. Cartwright, of Greenford. Hot-air engine.

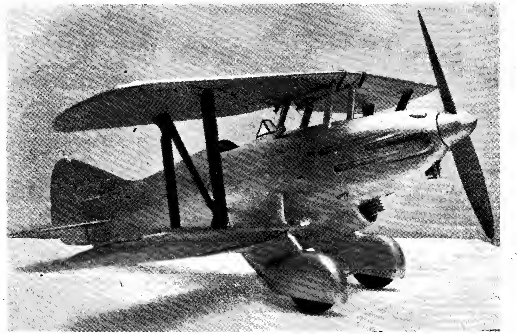
The Aircraft Section

by E. F. H. Cosh

WHILST the improvement in the standard of workmanship and finish was general throughout the exhibition, it was particularly noticeable in the Aircraft Section. The difficulty of producing an exhibition finish on a model aircraft is known to very few. Balsa wood, which is normally used for construction, is very soft and absorbent compared with other woods. Also, it is not possible to hide poor workmanship by a good finish—a glass-like surface only accentuates any imperfections. The winner of the Championship Cup, S. A. Miller, of Luton, is therefore to be congratulated on obtaining such a perfect finish on his winning entry. This model, which was fitted with a 1 c.c. diesel engine, was almost faultless in every detail. Its attractive colour scheme of dark buff and cream was carried out with Woolworth's paint applied by brush, and there is no doubt that it thoroughly deserved its placing. Another model which displayed a superb finish was an "Evander" sailplane entered by B. H. Dunster, of Folkestone, which was awarded a silver medal.

As one would expect from present trends, there was a marked preponderance of power-driven models, and a falling off in the number of solid scale models. Flying scale models were, however, more in evidence than in previous years, particularly amongst the control-line entries.

A disappointing feature was the small number of Wakefield entries and the lack of any improvements in the design of this class. Now that the Wakefield International Contest has been re-started, it is to be hoped that next year's exhibition will be better in this respect. A bronze medal was won by L. P. Mackenzie, of Wandsworth, for his streamlined monocoque model, but the remainder of the entries generally followed orthodox lines, with the possible exception of S. A. Miller's skeleton framework which was up to this modeller's usual high standard.



Winner of the Bristol Cup. Exhibit No. 323, "*Bristol* 123," *by G. A. Hobbs, powered by a* 1.3-*c.c. Mills diesel engine*

In Class 21, for rubber-driven models, there was an outstanding flying scale model of a Hawker "Fury," by A. L. Philpott of Folkestone, which deservedly gained a bronze medal for its fine detail work.

None of the solid model exhibits were up to "medal" standard, the best examples being a partly sectioned Avro Lancaster, entered by R. A. Springall of Sutton; the Gloster Gladiator, by I. O. Newton of Luton; and the Sopwith Triplane, by B. V. Manders also of Luton. These were each awarded Very Highly Commended Diplomas.

The original design class failed to produce any

models with outstanding features. Those with some claim to distinction were a well-finished power-driven biplane, by J. A. Newton of Blackheath, and a control-line model of a Supermarine S6-B, by P. Donavour-Hickie of Horley, although neither exhibited anything highly original in their design. These, and many other models also, appeared to have been entered in the wrong classes, and it would have saved the judges headaches and improved some of the entrants' chances of an award if competitors had given more careful study before completing their entry forms.

Amongst the Junior entries, J. C. Hawkins' (Basingstoke) rubber-driven Tiger Moth was a worthy winner of the Junior Championship medal because of its neat workmanship and finish. We should have liked to have seen a much larger entry from the juniors. Many fine models by "teen-agers" are seen on the competition field and it is difficult to imagine why they should not be more fully represented.

The power-driven model section, besides providing the Championship Cup winner, included many outstanding models. W. Barnes of Portsmouth, entered an excellent example of a semi-scale model powered by a 5 c.c. diesel engine, notable for the excellence of its engine cowling and the beaten aluminium wheel spats. An attractive biplane by L. E. Sharp of Feltham, was extremely well finished, and, in addition to winning a silver medal, it was awarded the *Model Aircraft* prize for the best control-line model on show. R. F. L. Gosling of Liverpool, entered a pylon-type model with a polished balsa planked fuselage, proving that a good show finish can be obtained without paint. G. E. Dunmore of Leicester, exhibited a pylon-type free-flight model and a control-line model, both of which were up to his usual high standard of workmanship.

The Luton & District M.A.S. were given a good start in the Club Championship, by S. A. Miller's Championship Cup winning entry, which was well supported by their other two entries, and we congratulate them on winning the Club Championship Cup. The Blackheath M.F.C. were runners-up, and Ealing M.F.C. third.

In order to save space, the aircraft models were suspended on wires above the Competition Section. This method of display did not, unfortunately, permit the models to be closely inspected, or to be seen to their best advantage. Nevertheless, this was more than offset by the marked improvement in the standard of the models over the previous two years, and it is to be hoped that this improvement will be continued in the entries at next year's exhibition.

For the Bookshelf

Two-Stroke Motor-Cycles. (Tenth Edition.) By the staff of the *Motor-Cycle.* (London : Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1.) Price 3s., postage 3d.

The latest edition of this popular handbook is issued at an opportune time, in view of the present interest in the lighter types of motor-cycles and auto-cycles, which represent the simplest and most economical means of mechanical transport, and owe their success to the small two-stroke engine. In addition to a good deal of technical information on this type of engine, the book also contains chapters dealing with transmission, lighting and auxiliary equipment, learning to drive, engine maintenance, tracing troubles, etc. An invaluable handbook not only to all users of these motor-cycles, but to all interested in any application of the small two-stroke engine.

The Novice's Workshop, Part 1. By Ian Bradley and Norman Hallows. (London : Percival Marshall & Co. Ltd.) 112 pages size $4\frac{3}{4}$ in. by $7\frac{1}{4}$ in. Price 3s. 6d. net.

This is the first of two excellent practical handbooks written primarily to help the reader who is intending to fit up a small workshop for light engineering and model work. Much of the contents are commendably elementary but always essentially practical, whether they are describing tools and equipment or how to use them. There are no fewer than 120 nicely-reproduced, clear, explanatory drawings to complement the text. We like the manner in which the authors have arranged their material, so that the reader is, as it were, led from stage to stage by well-planned progressive steps, while the advice given throughout is thorough and sound. The book undoubtedly fills a long-felt want, in that, although the ground covered is long-familiar, the outlook is in accordance with modern practice and thought; it is certainly most excellent value at the price.

Geometrical Drawing. By H. Binns. (London : The English Universities Press, Ltd., St. Paul's House, Warwick Square, E.C.4.) Price 8s. 6d.

It is well known that geometry is the foundation of all technical drawing as employed in engineering and architecture, but in this book, the use of geometrical principles in the construction of drawings by orthographic, isometric, pictorial and oblique projection, and in decorative pattern and moulding design, is given special emphasis. The book is intended as a basis for training in drawing office work, and will also serve as an elementary introduction to the more advanced books on engineering drawing by the same author. It contains numerous examples, problems and exercises in drawing, arranged in sequence to suit the progress of the student in acquiring drawing skill.

A $3\frac{1}{2}$-in. Gauge L.M.S. Class 5 Loco.

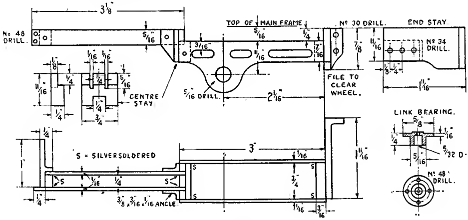
by "L.B.S.C."

NOW we come to the bit that caused me a lot of heartburning. The making up and assembly of the frame plates and stays doesn't appear difficult when you examine the illustrations, but I tried a lot of different arrangements before getting the easiest solution of the job. For the main parts of the frames carrying the expansion links, four pieces of $\frac{1}{16}$-in. bright steel, a little over 3 in. long, and $1\frac{1}{8}$ in. wide, will be needed. Mark one out to the given outline, and drill a couple of 3/32-in. holes anywhere in the location of the ornamental slots. Use as a jig to drill the other three plates, then temporarily rivet all four together, and saw and file the frames to outline. Drill a $\frac{1}{8}$-in. pilot hole through at the location of link bearing, then open out with a $\frac{5}{16}$ in.; this will ensure correct size and truth of holes. The ornamental slots need only be cut in two of the plates—or in none at all, if you don't care a bean what Inspector Meticulous thinks! They are 5/32 in. wide, the two short ones are $\frac{7}{16}$ in. long, and the long one $\frac{7}{8}$ in., spaced $\frac{1}{4}$ in. from each end of frames.

Our advertisers will probably supply a piece of cast angle which will be large enough for both the end stays or rear brackets carrying the back ends of both gear frames; and all that it will need in the way of machining, will be to cut it in two, file or mill up the bit that butts up against the frame, file the rest to the shape and size shown in the illustrations, and drill the holes for the screws. Two No. 30 holes are needed for the $\frac{1}{8}$-in. or 5-B.A. screws holding the bracket to the frames, and three No. 34, for the 6-B.A. screws holding the end of the gear frame to the bracket. Drawn or extruded angle can be used if desired.

The back ends of the gear frames are joined by a piece of $\frac{7}{16}$-in. by $\frac{3}{16}$-in. brass bar, squared off in the lathe to a dead length of $\frac{3}{4}$ in. A single screw, any small size you have handy, can be put through a clearing hole drilled in the frame, into a tapped hole in the end of the stay, to hold the lot together whilst the silver-soldering operation is in progress; the heads are filed off afterwards. For the centre stay, which supports the leading end of the main gear frames and the rear ends of the two supporting girders, a piece of brass bar $\frac{3}{4}$ in. wide, $\frac{1}{2}$ in. thick, and $\frac{11}{16}$ in. long will be required. A detail sketch of this is shown, illustrating how it will need machining. A rebate is first milled along one of the $\frac{3}{4}$-in. sides; this is $\frac{1}{4}$ in. deep, and cuts away exactly half the thickness of the block, leaving a $\frac{1}{4}$-in. tongue projecting upwards. The milling can be done exactly as described many times for milling axleboxes, with the bit of metal clamped under the slide-rest tool-holder, at the correct height for an endmill in the three-jaw to form the rebate at one cut. Feed into cut with the top-slide, and traverse across the cutter with the cross-slide. If you have a vertical slide, and a small machine-vice to attach to it, you're in the clover for jobs like these.

The next item is to mill two $\frac{1}{16}$-in. slots, $\frac{5}{16}$ in. deep and $\frac{1}{4}$ in. apart, in which to fit the ends of the forward girders. These slots can be cut exactly as described for valve-gear and other forks, clamping the bit of metal under the slide-rest tool-holder, and running it up to a $\frac{1}{16}$-in. saw-type slotting cutter on a stub mandrel held in the chuck. The gap underneath can be formed with a file, its exact size being of no great importance, as it is merely to afford clearance for the



Details of gear frame

radius-rod in back gear. The finished block is placed between the forward end of the main gear frames, and attached to same temporarily by another screw each side, same as the back end. The slotted part of the block should project upwards, above the main gear frames as shown, and the back ends of the front girders can then be jammed in the slots. The girders are simply bits of $\frac{5}{16}$-in. by $\frac{1}{16}$-in. steel strip; the outer one is $3\frac{1}{4}$ in. long, and the inner one $2\frac{3}{4}$ in. long. When the gear frame is erected, the outer one comes in front of the guide yoke or motion bracket, right at the top, see elevation of complete gear assembly.

The leading ends of the girders are supported by what looks like the "fag-end" of a gauge "O" buffer beam; in fact, that is where I got the idea. A piece of $\frac{1}{4}$-in. by $\frac{5}{16}$-in. (or $\frac{5}{16}$-in. square) brass rod is needed, 1 in. long, with one end squared off in the lathe. At $\frac{1}{4}$ in. from this end, mill a $\frac{1}{16}$-in. slot about 5/32 in. deep; about 3/32 in. beyond this, the block can be filed or milled away, as shown in the plan, or left full thickness, just as you fancy. Jam the inner girder into the slot, and attach the outer one to the faced end of the block, by another temporary screw. Now watch your step very carefully; see that both the main gear frames are absolutely parallel all ways, ditto the girders, and that the three supports are all nice and square. As extra support at the middle, two pieces of $\frac{3}{8}$-in. by $\frac{3}{16}$-in. by $\frac{1}{16}$-in. brass angle, filed away at the bottom, as shown in the elevation, are attached to the girders by a single screw, the narrow ends butting up against the centre stay as shown in plan.

All the joints marked "S" are now silver-soldered. Anoint each joint with a dab of wet flux, lay the whole doings on a piece of stiff asbestos millboard (if it rests directly on the coke in the brazing-pan, instead of on the millboard, it may probably go out of truth under the heat), heat to dull red, and apply a strip of good-grade silver-solder to each joint. Only a little is needed; I use "Easyflo" and the special flux sold with it, for jobs like these. Quench out in water only, on account of the steel, then clean up. When carefully carried out, this construction will be as strong as any casting, and a sounder job than putting the bits together with screws and rivets. All the superfluous temporary screwheads may be filed off, leaving a nice neat gear frame assembly. The bearings for the link trunnions may then be made and fitted; and for these, chuck a short bit of $\frac{5}{8}$-in. round bronze or gunmetal rod in three-jaw. Face the end, centre, start a hole with No. 22 drill, and finish it to $\frac{3}{16}$ in. depth with a 5/32-in. D-bit, so that it is square-ended. Turn down $\frac{3}{16}$ in. length to a tight push fit in the holes in the gear frame, and part off a full $\frac{1}{4}$ in. from the end. Reverse in chuck, face off the head, and then centre and drill a $\frac{1}{16}$-in. hole in the middle, as an air vent, and for oiling purposes. Four No. 48 holes are drilled in each flange as shown; and when the gear is finally assembled, the flanges are attached to the gear frames by four 9-B.A. roundhead screws in each.

How to Erect Gear Frames

First of all, attach the back support or end stay to the rear end of the gear frame, as shown in the plan view. The gear frame is located $\frac{1}{4}$ in. below the top of stay, see elevation, *but note particularly that the gear frame projects beyond the end of the stay, by the thickness of the outer plate.* The reason for this is, that the outer plate of the frame comes exactly under the running-board valance, which is the same thickness, and the stay projects upwards behind the valance; so that if stay and gear frame are erected level, you won't get the running board in place later on, and the G.P.O. will have to put on a special mail van to carry the half-a-million odd letters which would come along to emphasise my relationship with Billy Muggins. Temporarily clip the stay to the end of the gear frame in the position indicated, run the No. 34 drill through the holes in stay, making countersinks in the end member of frame, drill through No. 44, tap 6-B.A. and put screws in. I've shown hexagons on the assembly plan, but any kind will do, that you happen to have handy.

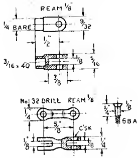
Now temporarily clip the whole bag of tricks to the main frame, setting the weeny hole in the middle of the link bearing at 1 in. from top of frame, and $4\frac{1}{16}$ in. ahead of the centre of driving axle. The outer front girder should just overlap the front of the guide yoke or motion bracket, as shown on the elevation of the complete assembly, but note, as the motion bracket is tilted a weeny shade, the front support which holds the girders together (the bit of "O"-gauge buffer beam) will have to be filed to suit. No good having fitters if they don't do an occasional spot of fitting! The top line of the girders should be $\frac{1}{16}$ in. below top line of main frames, and the top of the gear frames $\frac{5}{16}$ in. below ditto. When you have the whole doings in the right position, poke the No. 30 drill through the holes in rear stay flange, carry on through main frames, and secure the lot with a couple of $\frac{1}{8}$-in. or 5-B.A. bolts. Put two small round-head screws, say 9-B.A., through the outer girder into the guide-yoke, and either another $\frac{1}{8}$-in. or 5-B.A. bolt, or two 3/32-in. or 7-B.A.'s, through the front stay and the top of the guide yoke. That should be enough to stop the whole issue from falling off.

Fitting Up the Gear

Before making the eccentric-rods and fitting the return cranks, it will be necessary to erect the parts of the gear already made, as the exact length of eccentric-rods, and position of return-crank, have to be determined from the actual job. First of all, insert a pair of die-blocks in the expansion-link. They will go in quite easily through the space between the links, and if you put a little motor grease on each, they will stay in the grooves whilst the radius-rod is inserted. Line them up so that you can see the two pin-holes through the slots in the link, then put the radius-rod between them, lining up the hole in that, with the holes in the die-blocks; then drive or squeeze a $\frac{3}{8}$-in. length of $\frac{1}{8}$-in. silver-steel through the lot. This will be a squeeze fit in the rod, but a working fit in the die-blocks, which is as it should be.

Now put the top of the combination-lever in the fork of the radius-rod, and squeeze a $\frac{1}{8}$-in.

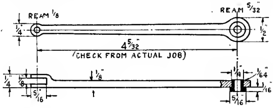
silver-steel pin through that, filing off flush each side, and attach the plain end of the union-link to the bottom of the combination lever in the same way. Take off the gear frame, and remove the two link bearings, then put the link in position; you'll find it easy enough to get the trunnion pins into the big holes, then hold each trunnion in the middle of the hole whilst you put the bearings back. When all the screws around



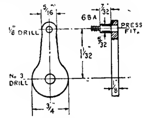
Valve fork and union link

the flanges are in, the link should oscillate easily but without any slackness whatever. Replace the gear frame; screw the valve fork or cross-head on to the valve-spindle, put the combination-lever between the jaws, and fix with a little bolt made from $\frac{1}{8}$-in. silver-steel, shouldered down each end to 3/32 in., screwed and furnished with nuts. Beginners note, these bolts should always be long enough in the plain part, to allow of them being turned by fingers when both nuts are screwed right home. This eliminates any chance of the bolt pinching in the jaws of the fork, and causing unnecessary friction in the gear parts. Finally, couple the loose end of the union-link to the drop-arm on the crosshead, to protect it whilst squeezing in the pin; then press the crank on the reduced part of the main crankpin, setting it in the position shown in the assembly elevation, as near as you can "by eye." Note, the spigot on the main crankpin will project $\frac{1}{16}$ in. through the return-crank boss; that is all in order for the time being.

For beginners' benefit, I will once more detail the method of getting the correct setting for the return-crank, and the exact length of the eccentric-rod, and this applies to *any* engine with Walschaerts valve-gear. You don't need any elaborate instruments, merely an ordinary pair of dividers; and regarding calculations, you don't even have to know how many beans make five. First of all, set the expansion-link in such a position that the die-blocks can be run from top to bottom and vice versa, without moving the valve spindle; then temporarily fix it there. I usually jam a bit of soft wood between the link and the gear frame. Now put the main crank on front dead centre; then with your dividers, take the distance from the centre of the hole in the tail of the link, to the centre of the return-crank pin. Next, shift the main crank around to back dead centre, and apply the dividers, without altering their setting, to the same points. If they tally exactly, you have an excellent excuse for a mild celebration; if they don't, shift the return-crank so that the pin moves *half* the difference, and try again. I have never known anybody to need more than three shots, to get it correct. When the distance between the centres of hole in link tail and return-crank pin, tally exactly on front and back dead centres of the main crank, the return crank is correctly set, *and the distance between the divider points is the exact length of the eccentric-rod between centres of bush and fork*, so don't shift them under any circumstances!



Eccentric-rod



Return crank

by means of the little countersunk bolt illustrated along with the union link, and "Bob's your uncle" for the time being.

Return-crank and Eccentric-rod

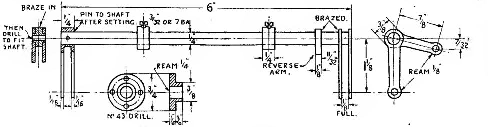
The return-crank itself is simply a plain filing job, made from $\frac{3}{4}$-in. by $\frac{1}{8}$-in. mild-steel. Drill both holes $\frac{1}{8}$ in. for a kick-off, then open out the hole in the larger end with a No. 3; slightly broaching it until it will just "start" on the end of the main crankpin. The little pin is made from a bit of 5/32-in. round silver-steel a bare $\frac{9}{16}$ in. long; one end is turned down for $\frac{1}{8}$ in. length, to a tight squeeze fit in the $\frac{1}{8}$-in. hole in the crank, and the other end is turned for a full $\frac{3}{16}$ in. length to 7/64 in. diameter, and screwed 6-B.A. Put a nut on the thread

File the projecting stub of the main crank-pin spigot, flush with the return-crank boss. Drill four No. 55 holes half in boss and half in spigot; countersink them, tap $\frac{1}{16}$ in. or 10-B.A. and put in four countersunk screws. They will hold the crank from slipping around or coming off of its own free will and accord.

As the eccentric-rod is made in the same way as the radius-rod, there won't be any need to recite the ritual again. The drawing shows the shape and size of it, but the distance between centres of fork holes and bush, must be measured from your already-set dividers, as mentioned above. Drill the boss $\frac{1}{4}$ in., and fit a little bronze bush in it, with a $\frac{1}{16}$-in. head, and allow the end of the bush to stand proud of the back of the rod, by 1/64 in., so as to prevent the rod rubbing on

the return crank. On the big engines, a ball-bearing is fitted here, and a needle-bearing could be used on the little engine if available; but of this, more anon. I have some very weeny ball and needle bearings, thanks to the kindness of two or three esteemed correspondent-friends, and hope to do a little experimenting in the not-too-distant future. The bush of the eccentric-rod is slipped over the return-crank pin, and

Centre and drill right through with No. 48 drill. Squeeze an arm on to each pip, lining up the with the No. 32 drill through the holes in the small end; then braze in the distance-piece. Quench out, clean up, ream the small ends ⅛ in. and drill the large end with letter C or 15/64 in. drill. This will cut out the pips, leaving a ring between the arms. Ream it so that it goes on the shaft very tightly.



Reversing shaft or weighbar shaft

stopped from falling off by a commercial nut and washer; the fork is attached to the link tail by a bolt similar to the one in the combination-lever.

Weighbar or Reversing Shaft

All we now need, is a means of reversing and notching up. The weighbar shaft itself is a piece of ¼-in. round steel, mild or silver, 6 in. long. Make the reversing-arm first, from a piece of ⅛-in. by ⅜-in. mild-steel 1¼-in. long, filed to shape shown. Drill both ends No. 32, ream the small one ⅛ in., open out the larger one with letter C or 15/64-in. and ream until it will just drive tightly on to the shaft, at 19/32 in. from one end. The lifting-arms are double, as on the big engines, and are made from ⅜-in. by 1/16-in. steel, filed to shape shown. Drill all four, same as reverse-arm, but only enlarge the bigger ends of two of them. These are driven on to the shaft at the same end as the reverse-arm, and set at an angle of 75 deg. from same, so that when the lifting arms are horizontal, the eye at the end of the reverse arm is 7/32 in. ahead of the vertical line. The distance between the two lifting-arms, is ⅛ in. full, so that the end of the radius-rod can slide freely between them. Braze all three arms to the shaft.

The lifting-arms at the opposite end of the shaft cannot be brazed to it, otherwise the shaft could not be put into place through the frames; also, the arms need adjustment, so that both pairs of die-blocks are in the middle of the expansion-links at the same time. I saw a professionally-made job some little time ago, in which, when the reverse-lever was in mid gear, one die-block was above centre and the other below it; so that the engine should have emulated the famous American locomotive of film conception, that went both ways at once. The two detachable lifting-arms are first brazed to a distance-piece. Chuck a bit of ⅜-in. round mild-steel in three-jaw, and turn a 1/16-in. pip on the end, to a tight fit in the hole in the larger end of one of the lifting arms. Part off a full ¼ in. from the end; reverse in chuck, and turn a similar pip, leaving a piece ⅛ in. full wide between the two shoulders.

The two bearing bushes are plain turning jobs, made from ⅜-in. bronze or gunmetal rod; or hard brass would do, as the wear is exceedingly small. Make them same as the link bearings, except that they are drilled right through, and reamed ¼ in. They are fitted to the ⅜-in. holes already drilled in the main frames, and secured by four 8-B.A. screws running into tapped holes in the frame. The collars for preventing side movement of the weighbar shaft, are simply ¼-in. slices of ½-in. round rod, with a 3/32-in. or 7-B.A. set-screw in each, drilled a sliding fit on the shaft.

How to Erect the Shaft

Poke the free end of the shaft through the left-hand bush, put on the two collars, continue through right-hand bush, and press on the other lifting-arm, setting the two pairs of lifting arms in line, as near as possible "by eye." Stick the two straight die-blocks in the slots in the ends of the radius-rods, with a bit of grease (don't get robbing the "marge" ration!) same as the die-blocks in the expansion-links; then turn up the weighbar shaft so that the arms embrace the radius-rod, and line up the die-block with the holes in the lifting-arms. Put a little bolt through the lot, same as those in the combination-levers and eccentrics-rods. Now set the left-hand die-block in the middle of the expansion-link; it is O.K. when you can turn the wheels, and the oscillation of the link doesn't move the radius-rod. With the weighbar shaft held in that position, see if you get the same effect the other side. If the radius rod moves when the wheels are turned, shift the lifting arm on the shaft until it doesn't. When the wheels are turned, and both radius-rods remain stationary with the reverse-arm in mid-gear position, the detachable arm is correctly set, and can be pinned to the shaft by drilling a No. 43 hole clean through boss and shaft, and driving in a stub of 3/32-in. silver-steel or 13-gauge spoke-wire. Run the two collars back against the bushes, tighten the set-screws, and the job is done. We will set the valves after the wheel-and-screw reverser is made and fitted.

A Half-minute Impulse Clock Movement

by C. R. Jones

HAVING bought a Government surplus component listed as a "12-volt selector drive unit," at what seemed a ridiculous price, from one of the advertisers in THE MODEL ENGINEER, it was decided that it could be easily converted to do duty as an impulse clock movement, and would do good work as a clock for kitchen use when connected up to the existing time circuit.

Photo 1 shows the unit as bought and before any stripping had taken place.

The first thing done was to carefully strip the unit, and everything was removed with the exception of the magnet and bobbin. The armature was removed by taking out the two screws holding the tension springs (*G*) operating armature.

All wiring and all extra contacts were removed, including the back-stop (*I*).

The ratchet wheel (*O*) had 104 teeth, and as a wheel with 120 teeth was necessary, this had to be removed, together with the selector switch it operated.

To do this it was found necessary to remove screws (*M*) at each end of the spindle, together with the T-shaped fingers they secured. Next, the small screws (*N*) and the forked plates retaining the bronze spindle (*B*) in position were removed.

On the ratchet wheel boss were two small screws which clamped the wheel to the spindle, and these had to be removed, after which, the spindle could be pushed through the wheel.

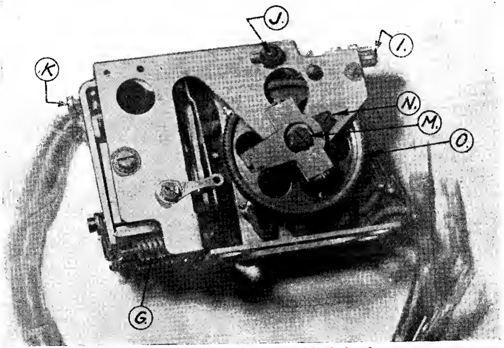


Photo No. 1. Showing unit as originally bought

It was found that as the spindle was larger at one end, it could only be pushed out in one direction.

After the wheel and spindle were removed, the selector switch itself was taken out by removing two small bolts which secured it to the framework.

This left just the framework containing the bobbin and electro-magnet (the bobbin in this instance was marked 4 ohms resistance).

The first step towards conversion was to make a new ratchet wheel with 120 teeth, and this was made from a piece of brass $\frac{1}{16}$ in. thick,

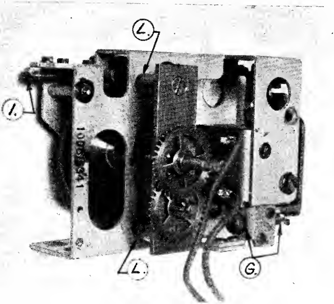


Photo No. 2. Showing front view of finished clock

and also $\frac{1}{16}$ in. larger in diameter than the original wheel, this being the largest size which could be accommodated in the framework.

The teeth on this wheel were cut with the rig-up shown in my article in THE MODEL ENGINEER, of April 1st, 1948, and a large 120-tooth wheel being available, this was mounted on the tail-end of the mandrel for dividing purposes, together with the usual detent.

It was decided to make use of the original spindle (*B*). This is of square section with rounded corners, and the original ratchet wheel (*O*) has a similar hole through its centre.

This hole measured $\frac{1}{4}$ in. across flats, so a piece of $\frac{1}{4}$ in. sq. silver-steel was set up in the four-jaw chuck and the corners carefully turned off until the wheel fitted on.

The wheel was then clamped on to the steel by means of the two small set-screws previously mentioned, and was checked to see that it ran perfectly true. (There is a plain portion at the rear of the wheel which is useful for setting-up.)

When satisfied as regards true running, the spoked portions were turned or parted through and the parallel portion of the hub was turned down to $\frac{1}{2}$ in. diameter, which diameter was carried along as far as possible to the flanged side carrying the set-screws.

A piece of hardwood was then mounted in the four-jaw chuck, and after facing off, a recess was turned a good fit for the new ratchet wheel, which was carefully pressed in and the hole in the centre bored out to a good fit on the parallel portion of the hub. The wheel was then pressed on to the hub (being careful to see that the teeth were facing in the right direction), and was sweated into position by means of one of the miniature gas blowpipes now on the market and finally given a polish up.

Having completed the ratchet wheel, the spindle (which had a hole right through and appeared to be tapped at each end No. 4-B.A.) was carefully set up in the lathe and the hole opened out to $\frac{1}{8}$ in. diameter.

The points where the set-screws pinched on the spindle could be seen on same, and one of these points was centre-popped and a clearance hole drilled at the same angle as the set-screws, right through into the hole just opened out in the spindle.

The object of this hole was to allow a longer screw to pass through and grip an extra spindle to operate the hands. Another and longer screw was found for this among the parts discarded.

The wheel and spindle were then assembled in the frame, making sure that the teeth on the wheel

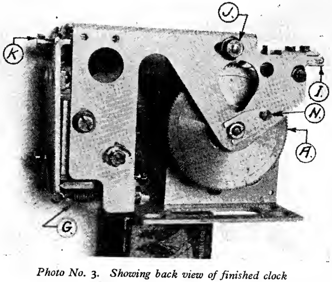


Photo No. 3. Showing back view of finished clock

were facing the same way as they did originally.

The next thing operated on was the armature (*H*). The flat spring on this was considered too strong, so it was thinned down on the top side (*X*), to about half its original thickness. It was found soft enough to file, using a very fine file.

The armature was then tried in position in

Two pillars were made from $\frac{5}{16}$ in. diameter mild steel, $\frac{3}{4}$ in. long, the ends of which were faced true, and were then drilled right through and the ends tapped No. 4 B.A. (See *L*, Photo 2.)

These pillars supported a plate made from $\frac{1}{16}$ in. thick brass, $2\frac{1}{2}$ in. long and $\frac{5}{8}$ in. wide, and this had a $\frac{1}{8}$ in. diameter hole drilled and

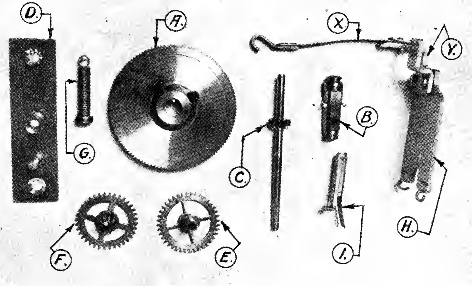


Photo No. 4. Showing components of clock

the frame, using the original springs (*G*), and it was found that the hook end, or pawl, did not come central on the teeth of the new ratchet wheel, but as this was only a small amount out, it was got over by bending the armature slightly at point (*Y*).

The backstop (*I*) suffered from the same complaint when tried in position, so a lighter and wider spring was riveted on in place of the original one.

As it was found that the original operating springs (*G*) were too strong, two lighter ones and two new screws were fitted.

Two springs which fitted on No. 3 B.A. C.H. set-screws were found, and when these were carefully adjusted and the stops (*I, J, K*) adjusted to what proved to be their best positions, the partly-finished clock was connected in series with the existing clock circuit, and was found to work quite well in conjunction with the other clocks, without the necessity of adding more battery power.

As no time could be registered so far, it was necessary to fit a 1-to-12 gear to operate hands.

Several 1-to-12 gears happened to be available, having been saved for years from defunct alarm and other clocks, and a pair of these was selected, together with their driving pinion.

broached through the centre to accommodate the new spindle.

In the framework there were two holes, through which originally passed the bolts which held the selector switch in position, and these holes were exactly 1 in. on either side of the centre of the main spindle bearing, so two other holes were marked off and drilled at 1 in. centres from the first hole in the new plate. These were drilled clearance for 4 B.A. and were then countersunk.

The wheels (E. & F.) were then drilled and broached out to be a nice working fit on a piece of $\frac{1}{8}$ in. diameter silver-steel, a piece of which was cut off long enough to go through the ratchet wheel spindle, with another $\frac{3}{4}$ in. for length of pillars, plus $\frac{1}{16}$ in. for thickness of plate, thickness of pinion, wheel (*E*) and a portion to carry a minute hand.

A small flat was filed on the spindle where the set-screw securing it to the ratchet wheel would grip, and the other end was slightly tapered off to carry a minute hand.

The spindle was then fixed by means of the set-screw and the two pillars (*L*) were attached to the plate by means of two 4-B.A. countersunk set-screws. The rear ends of the pillars were

(*Continued on page 303*)

DYNAMIC BALANCING

by B. J. Pleass, A.M.I.E.E.

THE necessity for dynamically balancing rotating parts in order to avoid vibration is generally understood. The balancing of rotating parts likely to be encountered by the model engineer should be well within the capacity of a model-maker's workshop, and provided the principles involved are understood, and reasonable care is taken in conducting the operation, accurate results can be obtained. In this article, the theory of dynamic balancing is very briefly explained, and a practical method of carrying out the work is described.

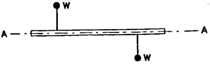


Fig. 1

Dynamic unbalance is of the type shown in Fig. 1, in which a shaft rotating about an axis *A-A* has two weights *W* attached to it, each at an equal radius and 180-deg. apart. It will be appreciated that although this shaft would cause severe vibration if rotated at a high speed, the unbalance present could not be detected by the simple method of rolling the shaft on two knife edges. The shaft is in fact statically, but not dynamically, balanced.

The unbalance in a fabricated rotor, such as a rewound armature or a turbine rotor having soldered or brazed on blades, is usually a combination of static and dynamic unbalance, in other words the rotor is like the shaft in Fig. 1 with unequal weights. Notwithstanding this complication, it is possible to show that any combination of static and dynamic unbalance may be corrected by the addition to the rotor of two weights only. Further, the two correcting weights may each rotate in any convenient plane perpendicular to the axis of rotation and at any convenient radius. In practice, the choice of suitable planes and radii for the two weights largely determines the accuracy of the balance obtained, since if the planes of rotation are very close, or the radii of the weights are small, the weights themselves become large, and good balance is difficult to obtain.

In the following method of dynamically balancing a rotor, a rewound rotary transformer armature has been chosen as an example. The armature, *A* in Fig. 2, is examined, it is decided that the best place for the correcting weights is on the two bands of binding wires B_1 and B_2, and that the weights may be in the form of solder run on the wires. This decision is made, since the weights are evenly distributed about the mass of the rotor, are near the periphery of the rotor, and are easily applied. The armature is supported in bearings in a light but rigid frame *F*. This frame is provided with two pairs of pivot points P_1 and P_2, fairly evenly spaced about the mass of the rotor. Initially, the frame is supported at one end by the two cone-pointed screws *S*, in the pivot points P_2, and by the two tension springs *T* at the oppostite end. The pin securing the springs to the frame is extended, and used as a pointer against a fixed scale *SC*. It is important for the frame support pivots and the armature bearings to be as free as possible. The armature is rotated by a variable speed motor *M* and a light belt or cord *C*. It is important for the cord to have as little weight and tension as possible, so long as it will rotate the armature without slip, and for the motor to have a constant speed once it has been set to any desired value. A line joining the centres of the armature and the driving pulley should coincide with the screws *S*, and the distance between the armature and the driving pulley should be considerable, say about 3 ft.

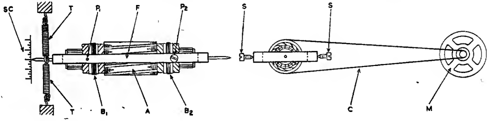


Fig. 2

The motor is slowly run up to the speed at which the frame has its greatest oscillation, the characteristics of the springs *T* having been chosen so that this occurs when the armature is rotating at a speed of some 200-700 r.p.m. Plasticine is then applied to the binding wires B_1 until no oscillation of the frame can be obtained. In this connection it is helpful to mark reference points, say by numbering the slots on the armature. The adjustment is then refined until balance is obtained with only one lump of plasticine. The plasticine is then removed, weighed, and an equivalent mass of solder run

on the binding wires B_1. A second check usually reveals some unbalance remaining, and in this case a further trial with plasticine will show that a smaller mass is required elsewhere around B_1. This is applied, the checking and application being carried out two or three times until no oscillation of the frame can be obtained, when the armature is running at the resonant frequency of the system.

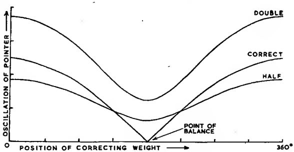


Fig. 3

When balance has been obtained with the frame pivoted at P_2, the frame is released from the screws S, turned round and pivoted at the points P_1, and the whole process is repeated, applying correcting weights to the band of binding wire B_2. When this is accomplished the armature has been dynamically balanced and should run smoothly at all speeds.

When the greatest accuracy is required, it is desirable to recheck both positions, refining the balance if necessary. Also, lightness and rigidity of the frame, freedom from friction at the bearing and pivot points, and accuracy generally in conducting the operation are most essential. It is helpful to draw a graph, plotting the amplitude of oscillation against the position of the trial weight round the armature. A picture of the sort of curve that may be expected is shown in Fig. 3, where the effects of a correct trial weight, a trial weight of half the correct value and a trial weight of double the correct value are shown. It is interesting to observe that the position of the correcting weight is most important. When the trial weight is of correct value, about 1/5th of the original unbalance force will remain if the weight is but 10 deg. away from its correct angular position. Constancy of the driving motor speed, once set, is most important, and in this connection, a commutator motor should be chosen, with the brushes connected directly to an accumulator or other D.C. supply having a good regulation, and the speed varied by series resistance in the field circuit. The voltages of the armature and field supply should be chosen so that the desired speed is obtained with the field having a fairly high exitation.

A Half-minute Impulse Clock Movement

(*Continued from page* 301)

secured to the holes in the framework by means of the two screws (M), which had been discarded when dismantling.

As the holes in the framework were larger than the screws, it was possible to line the plate up so that the new and old spindles ran freely in all three bearings.

The new spindle was then removed, and the small pinion of the 1-to-12 gear, after carefully broaching out, was pressed on in its correct position.

A $\frac{1}{8}$ in. diameter pin had been pressed into a hole suitably drilled and broached in the plate, to take wheel (F), and this pin had a $\frac{1}{16}$ in. diameter hole drilled at the top to take a split-pin to hold the wheel in position.

The whole was then assembled, and a temporary pair of hands fitted ; it was then given another test in the clock circuit, and after a good test, was found to be satisfactory.

A simple case was then made, really nothing more than a box with a glass lid, a sliding back, and a metal plate to which the dial is affixed. The clock movement was then fixed in position and furnished with a pair of hands, treated to a little clock oil, and is now working satisfactorily.

No provision has been made for altering the hands, but this should not be necessary if the time circuit is working correctly.

The clock is inclined to be noisy, but in its present position this is not a very great disadvantage, and no doubt with a bit of experiment this could be overcome.

The two wires to connect up the bobbin were soldered on the positions clearly shown in Photo 2, and were connected to two terminals on the clock case.

As the new ratchet wheel was made slightly larger than the original, it was found necessary to reduce the diameter of the inner end of stop (J), in order to give the operating pawl room to work satisfactorily.

The writer hopes this article may interest clockmaker readers, and also those who may be induced to start on a clock of some sort, electric or otherwise.

*A 1.5 c.c. Compression-ignition Engine

by "Battiwallah"

AT the end on which the crank-pin will be formed, drill 3/32 in. diameter for $\frac{1}{4}$ in. at the crank-pin centre and $\frac{3}{8}$ in. deep at the shaft centre; this last is rather important for, if it is not done, the centre will be lost when the crank-pin has been turned. To form the crank-pin it is quickest to remove the bulk of the surplus metal with a hack-saw, leaving a piece roughly $\frac{1}{4}$ in. square to turn down for the crank-pin.

Having drilled all four centre marks with a Slocombe drill, the rest of the work on the crank-shaft is largely straightforward turning. Leave the crank-pin about 3-thous. large and the bearing surface of the shaft about the same amount oversize. This is an allowance for final lapping. We must remember that as the main bearing bush has probably been reamed and is also to be finished by a final lapping, the final bore will probably be a couple of thous. over $\frac{1}{4}$ in., so allowance for this on the crankshaft must be made. The length of the shaft journal should be such that 1/64 in. projects outside the main bearing to provide the requisite end play of the crankshaft. The $\frac{1}{8}$-in. diameter hole, which can be drilled to a depth of say, $1\frac{1}{4}$ in., is merely to lighten the crankshaft and can be omitted if desired. The end of the shaft is shown screwed 0-B.A. This is a very convenient arrangement for adapting to most forms of drives, although it can be varied if desired; this is a matter of taste.

When it comes to lapping, it is not an easy matter to get into the corners of the crank-pin and the crank-web; hence, with a very narrow parting tool—not more than 1/32 in. wide—slightly relieve these corners. Having cut the crank-pin and the main shaft to length, and screwed the outer end of the shaft, the job is ready for case-hardening. For this, the procedure for hardening the main bearing is followed. It may be a little less easy to get "Kasenit" to adhere to the work than is the case with a hollow part and it may be found desirable to repeat the first heating and immersion in the hardening agent. Be very careful to plunge the work quite vertically for quenching; if this is done there should be no distortion. Thoroughly clean off after hardening and don't forget the hollow shaft, for "Kasenit" left behind corrodes.

The job is now ready for lapping and again, if you are not familiar with this, leave this part until we have dealt with lapping, which will be in connection with the next part.

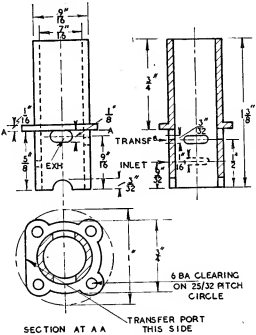


Fig. 11. The cylinder

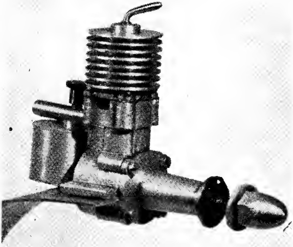
The Cylinder

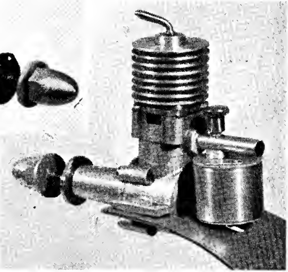
We now come to a component for which the highest possible degree of accuracy attainable within the limits of the means at one's disposal must be worked to. Quite a lot of machining is involved, for although the expert may decide to braze on the flange which will be seen in Fig. 11, or perhaps weld it on, this is not the course to be recommended to the less expert. Hence another piece of 1-in. round mild-steel of good quality is needed, about 2 in. long to allow for holding in the chuck.

Turn the exterior to the dimensions given in Fig. 11, leaving the diameter of the underside of the flange a few thous. over the diameter of the cylinder bore in the crankcase casting. Finish the cylinder bore with a boring tool, giving as smooth a finish as is obtainable. There is no need to continue the bore beyond the depth which will enable the job to be finally parted off to length, which can now be done. The ports can be drilled and filed to shape; they must be very carefully marked off and finished to the dimensions given in Fig. 11, for otherwise the timing will be wrong. The two exhaust ports are each $\frac{1}{4}$ in. wide and the transfer and the inlet ports are each $\frac{5}{16}$ in. wide. File out the notches for the connecting-rod clearances. Mark off the holes in the flange for holding the

**Continued from page 278, "M.E.," September 9, 1948.

cylinder to the crankcase casting with the Fig. 6 template, and be careful to use it the right side up so that the flat on the flange will coincide with the transfer port and the transfer passage in the casting, or else the holes will not register properly. Remove the burrs inside the bore and the job is all ready for the lapping operation. We shall now turn aside for a dissertation on lapping for the benefit of the uninitiated.





Two views of the 1.5-c.c. compression-ignition engine. The cooling fins screw on to the cylinder liner in this example, as will be seen in the illustration of the components.

Dissertation on Lapping

Briefly, lapping is a means of removing small amounts of material from the work surface by means of an abrasive material in a powdered form, the latter being held by a material which is considerably softer than the work surface. Copper is an ideal material for the lap for cutting hardened steel; the particles of the abrasive material become embedded in the copper and it acts upon the surface of the work in much the same way as emery cloth. The cutting process is necessarily slow and, until a selection of laps has been acquired, a lap has to be made for each job. Broadly, for our purpose, there are two sorts of laps, one internal and the other external. An internal lap is made by wrapping softened copper-sheet on a tapered steel mandrel, so that as the copper tube so formed is pushed further on the taper it is expanded as desired. External laps are made either from solid copper rod or from steel discs lined with copper; they can conveniently be made of a size which will enable them to be held in a screw die-holder, for this provides a means for adjusting the laps.

The mandrels for internal laps should taper about 0.02 in. in diameter per 1 in. in length, and the wrapped copper laps should be $\frac{1}{16}$ in. to 5/64 in. thick and about one-and-a-half times the length of the work to be lapped. External laps need be only $\frac{5}{16}$ in. to $\frac{3}{8}$ in. wide. Figs. 12*a* and 12*b* illustrate the two kinds of laps.

The sort of abrasive used is also a matter of some importance, for an unsuitable material will cause a waste of time. A medium grade of one of the "Axolite" grinding pastes works very well, with a fine grade for finishing.

The actual process of lapping consists of charging the lap with a small quantity of the abrasive and, with the work revolving at a moderately fast speed, working the lap to and fro, keeping it fairly tightly up to the work. Do not swamp the lap with abrasive paste; to do so will result in removing metal from spots where it should not be removed. One can tell by feel when the work is evenly and truly lapped, for when it is not so, the lap has an uneven feel. For instance, in lapping an external surface, as the lap is worked to and fro, the high spots will be felt by the grip of the lap and, with an internal lap, flat spots in the bore will be detected by the wobbly feel of the lap. It is really surprising how sensitive to feel are the irregularities. Lapping must be continued until all evidence of irregularities has disappeared. The final stages of the process should be done with an almost dry lap well tightened up to the work. At this stage considerable heat is generated

and the work is decidedly uncomfortable to hold; an old leather glove is rather useful for this job.

When gauging or trying the fit of the lapped parts, clean off all traces of the abrasive or you will get false results, for it is really surprising what a small quantity of foreign matter will cause trouble. Obviously then, in this connection, clean hands are advisable when fitting lapped parts together, hence again the usefulness of the old glove. Moreover, the slightest trace of abrasive left on the work is going to cause undue wear.

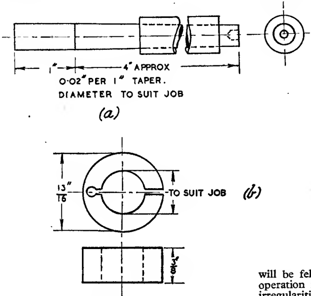


Fig. 12. (*a*) *internal lap*; (*b*) *external lap*

By careful lapping it is possible to finish to 1/10,000th of an inch; indeed a tolerance as close as this is desirable for the fit of the pistons and the cylinder.

Lapping the Cylinder

We can now resume work on the cylinder. Make an internal lap as shown in Fig. 12*a*. The tapered spindle should be about 5 in. long overall with about 4 in. tapered, the diameter at the smaller end being 9/32 in. Soften a piece of 13-s.w.g. copper-sheet 2 in. long and slightly tapering in width, and having a mean width of 1 5/32 in., and roughly bend it into a tube. Anneal it again and, by repeatedly pinching it up in the vice and hammering, conform the tube to the tapered rod. Remove the tube from the rod and pinch it up a little more in the vice so that the rod has to be driven in when the copper tube should be a fairly intimate fit throughout its length and expand evenly as it is driven farther on the rod. Now, with the tube driven only on the small end of the rod, skim the former just to fit the cylinder bore.

Lapping can now proceed; continue until all tool marks are removed and finish on a practically dry tight lap, when a mirror-like surface will be obtained. The work must be worked to and fro on the lap, and at the final stages the "feel" must be the same throughout the length of the cylinder; if it is not the bore is not parallel.

Now case-harden the cylinder and having thoroughly cleaned off all the remaining dross, not neglecting the ports, give the bore a further lapping. Provided the quenching was done by plunging the job vertically, there should be negligible distortion; any that has occurred

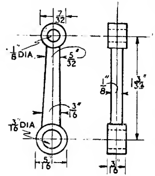


Fig. 13. *Connecting-rod*

will be felt on the lap and the further lapping operation must be continued until all traces of irregularities in feel have disappeared. A check on the feel of the job is a visual examination, for if any hollows are left they will be visible by the lack of bright polish when the bore is held to a strong light, although this will be no check on the parallelism of the bore. Of course, it should not be necessary to say that at this stage and onwards, under no circumstances should the cylinder be gripped in a vice or chuck, for it can easily be distorted, and the least little deformity will completely spoil the job.

The part of the liner which fits into the crank-case casting should have been finished parallel when it was turned. If distortion has been detected in the bore it is likely that it has also occurred externally, and we shall have to lap the lower part of the cylinder. (The upper part is not so vital because a less perfect fit affects only the rate of cooling; as compression-ignition engines run very cool, the efficiency of cooling does not worry us.)

A 9/16-in. lap, according to Fig. 12*b*, has now to be made. As it is required for the one little job only, it can be made from the larger of the headers sawn off the castings. It will not be very flexible and will not afford much take-up, but if it is bored to fit over the cylinder neatly it should "give" sufficiently to do its task. Hold the lap in the screw die-holder, adjusting the set-

screws as needed. To hold the cylinder for this job, insert the internal lap and drive in the taper pin, so that lap expands and holds the cylinder firmly. Then put the pin in the chuck and support the other end with the tailstock centre after threading on the lap, and start operations.

If you are satisfied that the bore in the crankcase casting is smooth and parallel, the final fitting of the cylinder into the bore can proceed; otherwise, leave the outer diameter of the cylinder about a thou. large and lap-finish the casting. The lap for this must be softer than aluminium or else the casting will lap material off the lap. A hardwood lap will do the job and it can be made to fit the taper-pin made for the cylinder bore lap. Again, with a hardwood lap there will be but little flexibility for take-up, so make it a neat fit in the bore. Finish it to size while it is forced on the end of the taper pin. Hold the lap spindle in the lathe chuck and the work in the hand. Cutting is much quicker than when lapping hardened steel, so don't overdo things.

The cylinder should be a push-fit in the casting. Do not make it a tight fit; you will distort the casting and the liner, and perhaps split the casting by fitting tightly.

The Connecting-rod

This can be made in either mild-steel or aluminium alloy. If the first metal is used the part should be case hardened and if the second is decided upon the piston metal used for the other castings suits very well; a length of a few inches can be made by pouring the molten metal into a small metal tray $\frac{1}{4}$ in. deep and about 1 in. wide, and 4 in. long. From this the requisite piece can be sawn with some to spare in case of accidents. File the piece of metal flat on one side, using this as the reference surface for drilling squarely and making the thickness measurements. Drill the two holes slightly undersize and finish by reaming. The rest is fairly easy filing work; use a spot of paraffin on the file for aluminium to stop the file from clogging. If mild-steel is used any small suitably-sized piece of good quality material will do and, again, filing is as good a way as any for shaping up the part. Case-harden it in the same way as has been described before. The alloy rod gives an advantage in engine speed.

The Pistons

The working piston is the one at the left in Fig. 14. The short one at the right is the compression adjusting piston.

The working piston is made from $\frac{1}{2}$ in. round silver-steel. Chuck a short length, face up the end and centre it with a Slocombe. Drill at 9/32 in. for a depth of 11/16 in., and open out at $\frac{3}{8}$ in. for $\frac{1}{4}$ in. depth. Bevel off the edge to give clearance for the connecting rod, and make a 9/32-in. diameter D-bit to square the bottom of the hole. Part off at $\frac{3}{4}$ in. Note that nothing has as yet been removed from the outside. Now step down a piece of $\frac{3}{8}$-in. round iron to fit without wobble in the inside of the piston, but don't make it a force fit or the little part will be damaged in removal from this holder. Part the latter off at about 3 in., and mark it for rechucking truly. Very carefully mark off the gudgeon-pin hole longitudinally at the centre of the piston. Then, with the holder inserted in the piston, drill the gudgeon-pin hole 7/64 in. through the lot, and open out with the $\frac{1}{8}$ in. drill. This drilling must be absolutely square, for if it is not the engine won't run freely, unless all the bearings are slack.

Now push a 13/32-in. length of $\frac{1}{8}$-in. diameter steel into the hole to hold the piston on the holder, when the job can be remounted in the chuck and the outside of the piston turned to size for finishing. And this is where another of the pitfalls will be met, unless you watch your step!

Adjust the cylinder lap so that it neatly fits the bore and then "mike" the lap in several places to find its maximum diameter which is, of course, the diameter if the bore of the cylinder. Turn the outside of the piston to finish 6-8 thous. large. This will allow for lapping out the

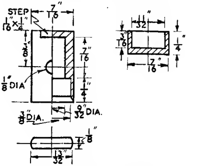


Fig. 14. *Working piston, gudgeon-pin and compression-adjusting piston*

tool marks and for distortion which, in a small degree, is unavoidable, as we are using silver-steel. There is no purpose in making this allowance too liberal because lapping hardened steel is a rather slow job—roughly 5 min. per thou. at the quickest.

The lap now has to be made (see Fig. 12*b*.) If you can, make it from a solid piece of copper bar, but failing this, a piece of annealed brass will do. Or it can be made from mild steel and a liner bent up from $\frac{1}{16}$-in. copper sheet and soldered inside. Whichever way it is made, bore out the business face truly and parallel.

With the piston still held on its holder and the latter chucked in the lathe, make a preliminary lap to remove the tool marks; this should leave the piston about five thous. oversize. File the $\frac{1}{16}$ in. by $\frac{1}{4}$-in. step at the top as shown in Fig. 14, and be careful to put it in line with the gudgeon-pin hole. The $\frac{1}{16}$-in. dimension is critical; it decides the opening of the transfer, and it also acts as a deflector.

Still keeping the piston on the holder, harden it, heating to a dull cherry-red and plunging vertically for quenching. Here is where the holder performs one of its principal functions which is to minimise the distortion on quenching.

(*To be continued*)

" *Grasshopper* " *and young*

DRIVING POSITIONS

by "1121"

DURING some fifteen years' running on many different tracks, of all types and lengths, the writer has had plenty of opportunity for investigating the advantages and disadvantages of various different modes of driving, and his experiences in this direction may be of interest to those with lines of their own, and those about to have them.

A word first about the track itself. There is really nothing like a ground-level track: an elevated track comes as a crippling restriction to those used to driving " on the floor." Apart from this, it is many times more expensive to install, gets in the way of other movements in a garden or similar site, and imposes severe limitations when any form of branching lines are contemplated. Added to all this, a derailment involves far more serious consequences from a height of two feet or more, and the chances of truck derailment by inexperienced passengers are higher and more disastrous in their consequences. The freedom of balance and impression of perfect control and safety experienced by a driver *in a suitable position* at ground level has to be felt to be believed. We have heard a little about high-speed runs in the passenger-carrying world, but the writer asserts with the utmost confidence that some runs recorded some ten years ago on a ground-level track in London would have been utterly impossible if the same track, with the same curves, had been of the high-level type.

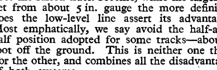
Let's be fair—what are the disadvantages of the ground-level system? First, it is more difficult to do any servicing or similar work on an engine when it is on the ground. Secondly, the track needs a proper bed, which must be carefully levelled in the first instance, and kept in decent trim if the track is to remain true. Thirdly, if the nature of the site is excessively undulating, it is difficult to avoid sharp gradients without resorting to high embankments or viaducts, which become virtually high-level sections, and any ground-level travelling position is definitely unsuitable for an elevated track in scales small enough to involve any degree of balancing by driver or passengers, unless the raised bed can be wide enough to give them a glimpse of something solid on either side of them. Furthermore, on a raised track with a minimum width of bed, it is practically impossible to dismount from low-level seating accommodation.

Believing that the advantages of a low-level track strongly outweigh its disadvantages, except in extremely abnormal circumstances, the writer urges most emphatically " keep it down." The prospective surveyor must, however, and undoubtedly will, decide for himself.

A qualifying factor is, of course, the gauge of the line. The smaller it is, the more suitable does the raised track become, while the larger we get from about 5 in. gauge the more definitely does the low-level line assert its advantages. Most emphatically, we say avoid the half-and-half position adopted for some tracks—about a foot off the ground. This is neither one thing nor the other, and combines all the disadvantages of both systems.

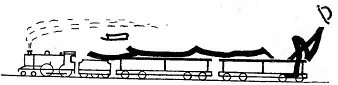
About the actual driving positions for ground-level tracks: we will list these under separate headings, thus:

1. *The Grasshopper.* The driver sits on the front end of an ordinary passenger truck, which is a standard flat car fitted with a seat about 6 in. high. A couple of boards, about 3 in. wide and a foot long, are supported between the front end of this truck and a stirrup over the tender.



The " Grasshopper "

These accommodate the driver's feet on either side of the tender. His attention is fairly evenly divided between (a) trying to decide whether to put his arms between his knees (which come up beside his ears like a pair of smoke-deflectors) or his knees between his arms, in an endeavour to reach the controls, and usually finishing up with a bit of both; (b) trying to keep his knees out of contact with any trees, posts, brick walls or other impedimenta which may be a bit close to the track (the higher his speed the worse does this trouble become with obstructions on the inside of a curve); (c) trying to see where he is going through the cloud of exhaust and blow-off steam, and wipe all the smuts and oil out of his eyes at the



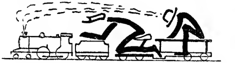
Left—The "Blimp"

Below—"Blimp" in full flight

same time (in this method of driving his eyes are in exactly the right position to receive anything that is going).

2. *The Blimp.* The driver lays full-length, and according to his personal contour is in a greater or lesser degree liable to "bale out" at the first curve. The engine and passengers are thus left to solve the problem between them, assuming the driver had left any room for passengers.

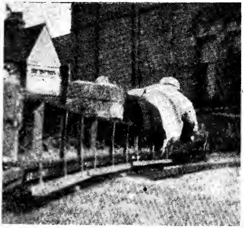
3. *The Creepy-crawlie.* The driver's knees and shins are supported by low-level boards on the front end of the truck, his toes dropping into small wells as close to the ground as possible. His seat is supported by a bicycle-saddle mounted on the top of the truck. His weight is fairly evenly distributed between the saddle and knee-boards. Slight pressure only need be taken by his elbows on the tender. This is by far the safest of the ground-level positions. The driver can nip the truck between his knees, and become virtually a part of it, which is the one essential to stability. His centre of gravity is low, and balancing becomes almost automatic on a wriggly track. His face is below the cinder-and-oil stratum which conveniently passes over his head to the passengers. This is by far the best position for all-round control and comfort, until the time comes to get off. The driver then finds he is permanently bow-legged, and 6 in. shorter. (Warning—in this position, the driver is liable to lift the rear bogie of the truck if no passenger is there to keep it down. Half-a-dozen bricks permanently carried under the passenger seat will obviate this.) A further point of interest concerning this position is that it gives the best



The "Creepy-crawlie"

"streamlined" shape to the driver. For amusement, the writer has sometimes sat on a ball-bearing truck on a level track, and been propelled the length of the line by the wind, merely by holding his coat open. From this it would appear that wind-resistance must be a considerable factor in high-speed running.

A word on the seating of passengers is opportune before leaving the subject. Don't make them too comfortable. Give them a good hard seat and narrow angle-iron footrests, and then they will feel sufficiently terrified to devote proper attention to the business of balancing. If you pamper them with cushions and wide footboards they will go to sleep and fall overboard at the first opportunity. Remember, they



probably don't know the road as well as the driver, and cannot see the curves coming as he can. Furthermore, when boarding the train they invariably commence by treading on the footboard nearest to them and tipping the whole outfit over. They should be warned against putting their feet down if they think they are going to topple over when travelling. This is the automatic reaction, but it must be checked, as its usual result is to fetch the whole train off the road. Even if it doesn't, they will find that their legs are too heavy to lift back on to the footrests, and the train will have to stop. Furthermore, it makes a beastly mess of the track-bed. If passengers can be trained just to touch the ground with the fingers of the hand on the appropriate side, they will find that it will afford instant correction with no ill-effects on the train.

The original "Creepy-crawlie"

Editor's Correspondence

"Sparks"

DEAR SIR,—Your remarks *re* the cover picture for July 22nd issue of THE MODEL ENGINEER show that you have omitted at least one very important factor in your deduction, i.e., exposure given.

Judging from the blurred outline of the man in the picture: on his right-hand "edge" he has distinct signs of having moved during the exposure, so causing his own image to overlap with that of the sparks.

Since he is standing still (nominally) his movements would have been tolerably slow, so that for his "slow" movements to be so apparent in the picture, the exposure given must have been relatively long, I would say in the region of ¼ to 1 sec.

In this time (¼ sec.) the sparks, if they are presumed to fall from rest, would travel no less than 1 ft., and in 1 sec. will fall 16 ft. (Formula: $S = ut + \frac{1}{2}gt^2$).

The particles of molten steel do not fall from rest, but are ejected from the surface of the molten metal with quite a high velocity (10-15 ft. per sec. in some cases), so that the distances quoted above are likely to be considerably exceeded.

This, therefore, explains the "trail," but there are still two points with which to deal.

(1) The particles emitted from the parent spark. These are extremely small, of the order of 0.002 to 0.005 diameter, judging by the size of the parent spark when cool (which appears to be in the region of 0.015 to 0.03 diameter). These are emitted in all directions and do not form a "trail" because:—

(*a*) They are not all shot out in the line of the trail, and

Molten "Pig" being poured into rear of open-hearth furnace. (Ladle contains approx. 30 *tons.)*

(*b*) They are so small that they cool almost instantly.

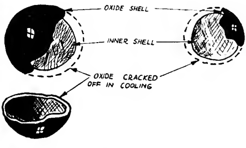
(2) The sparks that "go out" and reappear. These are the larger sparks that are shot out, so as to travel through a large distance (relatively) of air. The oxide coating of these is rapidly cooled and causes the hot interior to be "blacked-out." The stresses set up cause this oxide to crack off and leave the white-hot "kernel" to continue its spectacular flight. I have examined these "fallen stars" and give a sketch of some typical ones. These clearly show the cracked-off shell.

I may also add that the illusion of a trail and of size is due to "persistence of vision." The size of these particles as estimated by watching the "tracks" would be about $\frac{3}{16}$ in. to $\frac{1}{8}$ in. diameter, yet on examination they prove to be only about 1/32 in. diameter at the most.

The peculiar pattern of iron sparks seem to be due to a large parent spark emitting four or six more "child" particles, as shown in the sketch, but I have not been able to see if one "parent" has more than one set

of " quads " or whether the first set prove fatal.

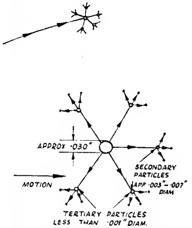
The emission of both secondary and tertiary particles is very rapid about 0.001 sec., and the only things visible are the trails which persist for about 0.1 sec. (the time of persistence of vision).



Steel particles (cold), showing oxide coating

If any particles are emitted from the tertiary particles of this is quite likely, they do not emit enough light to be seen in the " glare " of the primary and secondary particles.

I have had many opportunities of watching blast-furnaces tapped and molten " pig " poured into converting furnaces (oil-fired, open-hearth), and have come to this conclusion as the result of careful observation.



Sketch to show formation of " spark " from molten " Pig " iron

This operation is shown in the reproduced photograph herewith, and, as you can see, there is little trail effect.

For photographic readers, the details are 1/100 sec., F3.5, HP3 film, Merital-Caustic developer.

The length of the trail is almost always directly proportional to the exposure.

Yours faithfully,
Port Talbot. G. A. EVENISS.

Slotted-screws on Locomotives

DEAR SIR,—I am grateful to Mr. A. E. Williamson for his comments on the use of slotted-screws in small locomotives, but would have liked to have saved him the trouble of counting up screws for my information.

I have stood on many railway platforms and on many footplates, and I agree entirely on the probable number of these screws, and, although I have been at all times prepared to put screws in places where they are used in the big jobs, I have not always been prepared to make and fit these to the necessary scale size.

After all, a ⅜ in. countersunk bolt such as used in the running-board fixings for the old Brighton Atlantics had a screwdriver slot something like 3/32 in. wide, and to reduce this even to 1 in. scale would call for a screwdriver blade just about as thick as a razor. Rather than see a small screw with an outsize slot I invariably fit the much neater hexagon bolt.

Mr. Williamson is quite right in saying that what is correct on the prototype is correct on the " little sister," but some things are just too frail for scaling down and would have no strength if they were so treated.

I don't expect his own model entered in 1935 lost many marks on account of the screws he used, and I have some little recollection of the job in question—I believe it was a very well turned out job showing distinct signs of having been built by someone who knew the locomotive story pretty well.

Yours faithfully,
Worthing. T. I. AUSTEN-WALTON.

An Interesting Watch Lathe

DEAR SIR,—I have had the opportunity of showing the photograph of the Unusual Type of Watchmaker's Lathe, which appeared in THE MODEL ENGINEER of July 1st, 1948, to some relations who have been, for generations, in the Swiss watch industry.

It appears that this lathe was most probably built for the turning of old-fashioned balance-wheels of the now, more or less, obsolete " cylinder escapement " type (échappement à cylindre). These wheels used to have three spokes, and their rims had a semi-circular surface with a vertical straight edge (see sketch).

I hope this information will interest your correspondent.

Yours faithfully,
Morges (Switzerland). J. C. PIGUET.

Can Anybody Help?

DEAR SIR,—I have in my possession a half-completed model of an East Indian single-wheel locomotive which was started on seventy years ago. I should very much like to complete it, but have no sketch or drawings of locomotives of that date. I should be grateful if you could help me in this respect and for any information regarding the type of locomotives of that period.

Yours faithfully,
Leiston. W. F. HASLAM.